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Do medical cannabis growers attempt to produce cannabis with different concentrations than recreational growers?

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**Do medical cannabis growers attempt to produce cannabis with different
cannabinoid concentrations than recreational growers?**

ABSTRACT

Abstract:

Purpose: It is conceivable that cannabis cultivators who grow for medical purposes aim to improve the therapeutic index of their cannabis by attempting to produce particular concentrations of CBD and/or THC. This study examines whether small-scale medical cannabis growers differ from those growing for recreational reasons in terms of self-assessed concentrations of THC and CBD in the cannabis they grow.

Design: Data collection was conducted online from a convenience sample of 268 cannabis growers visiting a popular Israeli cannabis internet forum. Chi Square and Kruskal Wallis H were used to test bivariate associations between medical and recreational cannabis cultivators in terms of self-assessed cannabinoid concentrations.

Findings: 40% of cannabis growers reported that they grow for medical purposes. Medical cannabis growers were more likely to report that they thought they knew the cannabinoid concentrations of the cannabis they grew and they reported higher self-assessed concentrations of THC, but not CBD.

Value: Compared to recreational growers, medical cannabis growers are more likely to strive to be informed in terms of the content of their cannabis. Medical growers may also be attempting to grow more potent THC but not CBD cannabis.

Keywords: medical cannabis; cannabis cultivation; potency; THC; CBD

INTRODUCTION

Cannabis is the most widely used controlled drug in the world. While most commonly used for recreational purposes (e.g. to get high, socialize), cannabis is increasingly being recognized and used as a remedy for various medical symptoms and conditions (The National Academies of Sciences 2017). Cannabis contains numerous cannabinoids, but Δ 9-tetrahydrocannabinol (THC) and Cannabidiol (CBD) are typically the most concentrated components (Russo 2011). THC is usually the most prevalent psychoactive constituent, producing the “high” associated with cannabis use. THC can also induce anxiety, psychotic-like experiences and cognitive impairment (Colizzi and Bhattacharyya 2017). At the same time, research shows that THC possesses immunosuppressive and neuroprotective properties (Jamontt et al. 2010). Furthermore, research suggests that CBD has neuroprotective, anti-inflammatory and anti-oxidative properties (Campbell and Gowran 2007; Cheng et al. 2014) and that it may attenuate the psychotic-like effects of THC (Russo 2011).

Small-scale (non-commercial) domestic cannabis cultivation has grown rapidly in Europe and North America over recent years (Chadillon-Farinacci et al. 2015; Potter et al. 2015; Davenport and Caulkins 2016). Yet, small-scale growing is likely to supply only a modest share of the overall cannabis market, especially in jurisdictions that have legalized cannabis which in turn is associated with increases in large scale cannabis cultivation and “professionalization” of the cannabis market (Davenport and Caulkins 2016). Furthermore, research has found that people who report that they grow cannabis to provide themselves or others with cannabis for medical purposes (henceforth “medical cannabis cultivators”) represent a substantial proportion of small-scale cannabis growers (Hakkarainen et al. 2015; Hakkarainen et al. 2017).

It is possible that “medical cannabis cultivators” differ from “recreational cannabis cultivators” in terms of the self-assessed THC and CBD concentrations in the cannabis they grow because of a desire to achieve a selective breed of cannabis that is thought to improve the therapeutic index. Because THC is the main psychoactive ingredient and because medical users may not seek the psychoactive effects of cannabis, medical cultivators may attempt to achieve lower levels of THC than recreational growers. Indeed, there is some evidence that medical cannabis patients prefer lower THC cannabis because it treats their symptoms without the accompanying psychoactive highs (Harris et al. 2000). Nevertheless, THC is known to have therapeutic effects and thus there is also reason to expect that medical growers may not attempt to produce lower THC concentrated cannabis than recreational growers. Since CBD is known to have therapeutic effects, but no psychoactive effects, medical cannabis cultivators may be more likely than recreational cannabis cultivators to attempt growing high CBD cannabis. It is also possible that the differences between growers lie in the CBD:THC ratio, that due to the potential therapeutic benefits of both THC and CBD medical cannabis growers may be more likely to attempt a relatively balanced CBD:THC ratio.

The aim of this study is to expand the knowledge on medical cannabis cultivators by examining whether small-scale medical cannabis growers differ from those growing for recreational reasons in terms of self-assessed concentrations of THC and CBD in the cannabis they grow. The sample consists of small-scale cannabis growers in Israel. Israel is an interesting case study for the current project as it is the home of an established medical cannabis program. Indeed, the Israeli Ministry of Health has been running a cannabis program since the 1990s and there are (as of 2017) approximately 28,000

licensed medical cannabis patients in Israel (Zarhin et al. 2018; Tandowski et al. 2019). There are eight private growers who legally supply these patients with medical cannabis. Israeli cannabis policies do not allow for home growing for medical or recreational purposes. Nevertheless, unlicensed medical cannabis use has been reported (Sznitman 2017; Tandowski et al. 2019) and the current study focuses on a sample of cannabis cultivators who grow cannabis illegally.

METHODS

Data for this study stem from the Israeli version of the International Cannabis Cultivation Questionnaire (ICCCQ) developed by the Global Cannabis Cultivation Research Consortium (GCCRC) to measure patterns of small-scale cannabis cultivation (Decorte et al. 2012). The methods and data of the GCCRC study has been described in depth elsewhere (Barratt et al.). The current study is based on Israeli cannabis growers who reported cultivating within the last 5 years. Respondents were recruited through the Israeli Cannabis Magazine, a popular cannabis internet forum in Israel. A link to the online questionnaire was placed on the website and the forum moderator encouraged users to participate through social media. After informed consent was provided and inclusion criteria fulfilled (age > 17), respondents completed the anonymous survey. The study was approved by the Institutional Review Board of the Faculty of Social Welfare and Health Sciences at the University of Haifa.

Variables

Medical vs. recreational growers was measured by asking the respondents whether or not they grow in order to (a) “provide others with cannabis for medical reasons”, or (b) “provide myself with cannabis for medical reasons”. In total, 13 respondents reported

growing to provide others with cannabis for medical reasons, 73 reported growing to provide themselves with cannabis for medical reasons, and 13 other respondents reported in the affirmative to both questions. Sub-group analyses were not feasible due to insufficient cases in each category. Therefore, affirmative responses to any of these questions were coded as medical cannabis growers (= 1), otherwise respondents were coded as recreational growers (= 0).

Cannabis concentrations: respondents were coded in terms of whether they reported that they knew the concentrations of the cannabis they grow (0 = no, 1 = yes). Those who answered in the affirmative were subsequently asked how they know the concentrations (by relying on source of seeds/cuttings; relying on feeling/experience; by measuring with a kit/laboratory) and to report, to the best of their knowledge, the average THC and CBD concentration in the cannabis they grow. We also calculated the THC:CBD ratio.

Sociodemographic variables: gender (0 = female, 1 = male), age (18-74), whether respondents had a university degree (0 = no, 1 = yes) and worked fulltime (0 = no, 1 = yes) were recorded.

Statistical models

Bivariate associations between medical and recreational cannabis cultivators and demographic background and cannabis concentrations were assessed using Chi Square tests for categorical variables and Kruskal Wallis H test (due to non-normal distributed data) for continuous variables. Statistical analyses were conducted with SPSS (2010).

RESULTS

Almost all respondents were male (95%), the mean age was 28 years (S.D. = 8.58), 32% of the sample had a university degree and 47% reported working full time (Table 1a). Overall 40% of cannabis growers reported that they grow for medical purposes. There was no significant difference between medical and recreational cannabis growers in terms of gender or average age ($p > 0.05$). However, medical cannabis growers were less likely to have a university degree (25% vs. 37%, $p = 0.038$) and less likely to be working full time (34% vs. 54%, $p = 0.001$).

[Table 1]

Medical cannabis growers were more likely to report that they thought that they knew the concentrations of the cannabis they grew compared to recreational cannabis growers (72% vs. 57%, $p = 0.006$). When conducting further analyses on the sub-sample that reported knowledge of cannabis concentrations ($n = 167$, Table 1b), results showed no differences in terms of methods used to test the concentrations. The most commonly reported source of knowledge was relying on source seeds/cuttings (75%) while very few (4%) reported relying on a kit/laboratory.

A large range of estimated cannabinoid concentrations were reported (THC: 3 – 42%; CBD: 0 – 44%). While there was no difference between medical and recreational growers in terms of assessed CBD concentration and THC:CBD ratio ($p > 0.05$), medical cannabis growers reported higher THC concentrations compared to recreational cannabis growers (mean = 20% vs. 17%, $p = 0.026$).

THC and CBD concentrations as high as those reported by some of the respondents seems highly unlikely. For instance, in a recent report from the Netherlands, it was found that the highest THC cannabis content products on the market was 27%

(Rigter and Niesink 2017) whereas a few respondents in the current sample reported up to 42% THC. To test whether there were group differences once very extreme estimates were excluded, we tested mean differences again, this time excluding respondents reporting THC > 27%. Once these outliers were excluded there were no mean difference in assessed THC levels between recreational and medical cannabis growers, nor did the exclusion change the insignificant mean differences found for the full sample for CBD and THC:CBD ratio.

DISCUSSION

The current study shows that in this sample of Israeli cannabis cultivators, there is a relatively large proportion who grow for medical reasons. The results are consistent with those from a separate Israeli sample of cannabis users which found that 38% use cannabis for medical reasons (Sznitman 2017), and an international study of small scale cannabis growers that showed that 45% grow for medical purposes (Hakkarainen et al. 2017). It is, however, important to point out that the current study was conducted in a self-selected sample of visitors of an online discussion forum which limits the ability to assess its representativeness of cannabis growers in Israel. This method was, however, chosen because it provides ease of access, broad reach, anonymity, and reduced response bias on sensitive topics (Ramo et al. 2012).

Results reported here further show that medical cannabis growers were more likely to report that they thought they knew the concentrations of the cannabis they grow. This suggests that medical growers may have more interest in knowing the concentrations, potentially because they aim to improve the therapeutic index of their cannabis. Medical cannabis growers also reported higher self-assessed THC

concentrations but not higher CBD concentrations which run counter to the expectation that medical cannabis users try to avoid or minimize the psychoactive effects of cannabis (Harris et al. 2000). Yet, unpublished data from Israel shows that medical cannabis licensed chronic pain patients in Israel tend to use high THC cannabis (Meiri 2019). One of the questions that this raises is that respondents may define themselves as medical growers as a strategy to minimize stigma and legitimize their growing and using practices, whereas the boundary between medical and recreational use is actually quite blurred (Hakkarainen et al. 2017). More research on how and why some growers define themselves as medical growers is needed to explore this further.

The extent to which the self-reported concentration levels are correct is not possible to determine with the current data. Indeed, there is a potential discrepancy between self- assessments and actual concentrations of the cannabis produced, especially since very few cultivators reported that they base their concentration assessment on kit/laboratory testing. Furthermore, studies based on legally produced cannabis show discrepancies between actual THC and CBD content and the THC and CBD content reported on cannabis packaging (Vandrey et al. 2015; Bonn-Miller et al. 2017), indicating that even in legal markets the ability or willingness to objectively and correctly test THC and CBD content is limited. There is therefore reason to believe that there are discrepancies between the self-assessed THC and CBD levels reported by our respondents and objectively measured levels. The current results suggest that medical cannabis growers may be particularly prone to over-estimate the THC levels of their cannabis. Indeed, in sensitivity analyses excluding extremely high self-assessed THC estimates results failed to replicate the full sample result that medical cannabis cultivators

report higher mean THC. Future research with objectively lab tested cannabinoid concentrations is needed to better understand the validity of self-reported cannabinoid concentrations among small scale growers.

As opposed to interpreting the results of the THC/CBD self-assessments as objective indicators of cannabis concentrations produced by respondents in this sample, the assessments may be interpreted as growers' general aspirations and expectations in terms of the concentrations of the cannabis they grow. In this regard it is somewhat surprising that medical growers did not report higher CBD levels than recreational growers, seeing that CBD has no psychoactive effects but is known for its therapeutic effects. The results may be seen as an indication that medical growers are unaware of the therapeutic effects of CBD. It could also be the case that while they think that CBD is therapeutically beneficial, small/moderate dosages are seen as preferable. Considering the lack of research in this area there may be a need to conduct qualitative research in order to better understand the associations found in the current study.

The results presented in this paper show that medical cannabis growers may be particularly likely to aspire to improve the quality of their cannabis which suggests that they may be interested in reliable information and advice on what concentrations are suited to what conditions, and on how to produce cannabis with the most beneficial concentrations or THC/CBD ratio. At present there is not enough research to inform the development of such guidelines. More research is needed that can provide safety guidelines for the use of different cannabis concentrations, how to achieve these levels and how to test for it.

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Table 1a. Sample characteristics and bivariate associations between medical and recreational growers

	Total (n=268)	Recreational cannabis growers (n=169, 63.1%)	Medical cannabis growers (n=99, 39.6%)	Statistical test
Sociodemographic background				
Male, n (%)	255 (95.1)	164 (97.0)	91 (91.9)	$\chi^2(1) = 3.549, p = .058$
Age, mean (S.D.)	28.02 (8.58)	27.91 (7.98)	28.21 (9.55)	$\chi^2(1) = 0.324, p = .569$
University degree, n (%)	86 (32.3)	61 (36.5)	25 (25.3)	$\chi^2(1) = 3.611, p = .038$
Work full time, n (%)	125 (46.6)	91 (53.8)	34 (34.3)	$\chi^2(1) = 9.541, p = .001$
Cannabis growing				
Know potency, n (%)	167 (62.5)	96 (56.8)	71 (72.4)	$\chi^2(1) = 6.953, p = .006$

Table 1b. Bivariate associations in subsample (n=167, 62.5%) who reported knowledge of potency

	Total (n=167)	Recreational cannabis growers (n=96, 57.5%)	Medical cannabis growers (n=71, 42.4%)	Statistical test
Know by relying on source seeds/cuttings, n (%)	124 (75)	73 (77.7)	51 (71.8)	
Know by relying on feeling/experience, n (%)	34 (20.6)	19 (20.2)	15 (21.1)	$\chi^2(1) = 2.502, p = .286$
Know by measuring with a kit/laboratory, n (%)	7 (4.2)	2 (2.1)	5 (7.0)	
% THC, mean (S.D.)	18.31 (6.19)	17.30 (5.02)	19.63 (7.28)	$\chi^2(1) = 4.986, p = .026$
% CBD , mean (S.D.)	5.08 (6.43)	5.38 (6.38)	4.74 (6.51)	$\chi^2(1) = 0.101, p = .751$
THC:CBD	8.79 (7.17)	9.64 (7.32)	8.00 (6.99)	$\chi^2(1) = 0.483, p = .487$

Note: THC = delta-9-tetrahydrocannabinol; CBD = cannabidiol; SD = standard deviation.